Separate mention of the cultures that were classified as double (-) by transduction test must be made partially because the results are more incomplete and partially because they may offer some additional information upon the transduction phenomenon. Four such (—) have been obtained, three of the gal_1-gal_2- type and one of the gal_2-gal_4- type. The evidence that such cultures are (--) is that they are transduced not either by homotypic nor heterotypic lysates but are transduced by wild type or some other gal (-).

Lysates of these (--) cultures have been found to have little transducing activity regardless of the gal (-) tester used with but one exception. Whether this implies a failure of the phage particles to pick up a fragment of cell chromosome or whether the resultant thansduction is not phenotypically (+) through some interaction among the genes concerned is not known. The exceptional case resulted in the recovery of each of the (-) making up the (—) individually and not conjunctively. The homotypic locus transduced with this lysate was not recovered among the segregants.

As might be expected the (—) are more stable on galactose medium and have seldom been seen to revert.

Some experiments of interest have been performed with one of the (—) obtained. It was unfortunately a prototroph and the results obtained with it must also be repeated and extended with auxotrophic strains.

Although this (—) was not transduced by either, lysates of wither (-) singly it was transduced to a lesser extent (where a solid layer of papillae with a (-) would have been obtained, less than 100 papillae were found by a mixture of the two HFT lysates). In this case it was taken that the cells transduced to (+) had received two phage particles with the addition of two (+) alleles in separate segments.

The cell that was transduced to (+) may be represented as follows:

$$---2^{-}--1^{-}---*$$

and the resultant transduction as follows:

$$\begin{array}{l} ---2^{-}--1^{-}---* \\ \quad -2^{-}--1^{+}- \\ \quad -2^{+}--1^{-}- \end{array}$$

In this case the extra (-) added in the segments are inferred from the results with transductions of single (-) in which the heterotypic locus is recovered among the segregants. Segregation from this transduction in the absence of crossing over or exchange between chromosome and segments can result in three types of (-) segregants.

(1) $---2^{-}--1^{-}---*$ (2) $\begin{array}{l} ---2^{-}--1^{-}---* \\ \quad -2^{-}--1^{+}- \end{array}$ (3) $\begin{array}{l} ---2^{-}--1^{-}---* \\ \quad -2^{+}--1^{-}- \end{array}$

which would be classified as (—), (2^{-}) and (1^{-}) presumably. With exchange between segments and the chromsome segregants with the (+) alleles would be found in the chromsome and subsequent segregation would yield(in addition to the types 2 and 3 above with the (+) transposed) the following types:

(4) $---2^{-}--1^{+}---*$ (5) $---2^{+}--1^{-}---*$

An additional type can be obtained if there be exchanges between segments. The order of frequency of exchange and segregation of the above types is unknown but on analogy with the simple transductions the first three mentioned would be expected most frequently, that is, loss of a segment is more frequent than exchange and loss of a segment.(This in turn is dependent upon the independence of exchange and loss) Examination of 24 separate segregants from one such transduction gave the following distribution of segregants by transduction test: 13 (—), 6 (1^{-}) and 5 (2^{-}). Since over 50 percent of the segregants were (—) it appears that when loss of a segment occurrs it is more likely to involve loss of both segments. The (1^{-}) and (2^{-}) found could be of two types, 2,4 and 3,5 above respectively. These types can be distinguished by means

of analysis of (+) reversions. In cases 2 and 3 the reversions will be unstable and segregate, and in cases 4 and 5 they will be stable for galactose. Reversions were examined for their stability from each of the (-) obtained. All the (1^-) ~~xxxx~~ gave stable reversions and therefore were presumably of the $---2^+--1^-----*$ type. Of the (2^-) examined all but one gave stable reversions and therfore the two types $---2^---1^+---*$ and $\begin{matrix}---2^-\\-2^-\end{matrix}\!\!-\!\!\begin{matrix}-1^+---*\\-1^+-\end{matrix}$ were indicated with the most frequent being the former.

Examination of the ~~xxx~~ (2^-) culture giving the unstable reversions showed that it ~~xxxxx~~ did segregate (—) cells but as yet it has not been established that it segregates (2^-) of the following type $---2^-----1^+---*$.

The reversions of ~~this~~ the type 2 (2^-) can be of two types and they should (perhaps) be distinguishable in turn by the segregants that they yield. Reversion of the form $\begin{matrix}---2^-\\-2^+\end{matrix}\!\!-\!\!\begin{matrix}-1^-----*\\-1^+---\end{matrix}$ should be expected to segregate (—) predominately and reversions of the form $\begin{matrix}---2^+\\-2^-\end{matrix}\!\!-\!\!\begin{matrix}-1^-----*\\-1^+--\end{matrix}$ should be expected to segregate (1^-) predominately.

Reversions of the type 2 (2^-) appear to be of two types. From one type 33 segregants were obtained, of which 32 were (—), the remaining one a (2^-). The other type gave almost equivalent amounts of (2^-) and (—) and no (1^-) thus far. The failure to recover (1^-) types from the ~~xxx~~ reverted cultures is disturbing but this may be related to elimination of the gal_1 locus in crossbs. Presumably crosses between $\begin{matrix}---2^-\\-2^-\end{matrix}\!\!-\!\!\begin{matrix}-1^-----*\\-1^+---\end{matrix}$ and $---2^+--1^-----*$ should yield a larger number of (+) than crosses between (1^-) and (2^-) of normal constitution when there is sucessful transfer of the segment through the zygote. these (+) in addition would be unstable for galactose. The culture used unfortunately is a prototroph and unless sucessful crosses between it and a Hfr strain can be accomplished the problem can not be attack from this aspect. (Sucessful transmission of the segment through the zygote was observed in some early experiments not related to the above.)

Examination of another (—) has begun. In this case Gal_2^- and Gal_4^- are involved and a crossable stock has been selected. There has been another complication in this case. That is when the culture was first isolated, and also in the case of a repeat test, it was not found to be transduced by either (2^-) or (4^-) lyssates. In several additional tests it has also reactive in this manner. In the instances where it was attempted to obtain transductions by mixtures of the two lysates it was found that the culture was transduced, to a lesser extent, by lysates of (2^-). It was thought to explain this incongruent result by postulating that reversions had occurred during the growth of the culture and that in effect the culture consisted of (—) with (4^-) contaminants. On this assumption the aberrant transductions of the culture would in effect be of the form (2^-) —x (4^-) and the resultant transductions would be expected to segregate (4^-) predominately. This was not the case, of the six segregants examined (from six separate transductions) 3 were (2^-), 2 were (—) and only one was (4^-). This does not rule out the explanation but requires a great frequency of exchange between segment and chromosome for compatibility.

Examination of this culture had progressed to the stage of isolating a (4^-) segregant that gave unstable reversions as well as a type which did not, at the time of writing.

Not all of the Gal- cultures studied have been found transducible although the most frequently occuring (-) after ultraviolet radiation appear to be of this type. Three distinctly different occurrences of non-transducible gal- have been found. Two of these were induced by ultraviolet, and the third by copper exposure (H. Byers). One of the ultraviolet mutants has been examined to some extent. The results are given in table 18. It appears that this (-) is not transduced by any of the lysates and futher that lysates of it in turn transduce all known transducible loci, but Gal_2 with lowered frequency.

Table 18
Analysis of a Non-transducible Galactose Locus in W2312
by Transduction Assay

Experiment		Plate Additions: None	HFT Lysates: Gal_1-	Gal_2-	Gal_4-	NFT Wild Type
206	(1)	0*	0*	0*	0	-
	(2)	0	0	-	-	0
220	(1)	0	0	0	0	-
	(2)	0	0**	0**	0**	0

* number of papillae per plate
** NFT (normal frequency of transduction) lysates used in these cases

Table 14
Activity of Lysates of W2312 on Selected Galactose Loci

Galactose Locus		Plate Addition: None	W2312 Lysate
Gal_1- Lp^+		4*	37*
Gal_2- Lp^+	(220)	8	7
	(221)	19	28**
Gal_4- Lp^+		17	74
Gal_6- Lp^s		3	121

* numbers of papillae per plate
** 12/12 examined were found to be stable Gal+

Table 15
Results of Crosses of W2312 with Selected Galactose Loci

Selected Galactose Locus	Numbers: Gal+	Total Prototrophic Recombinants	Percent Gal+
Gal_2- F^-	1	2112	0.05
Gal_4- F^+	1	198	0.5

For the purpose of collecting new gal- and for observing the occurrence of transducible loci two separate experiments were performed. Gal- mutations were induced in W1673 (glyc or ser)$^-$ pro$^-$ and W1765 hist$^-$ leuc$^-$ by means of ultraviolet. Table 19 gives a summary of these experiments. Reccurrences of both Gal_1- and Gal_2- were found as well as a number of new loci and possibly several (—). No recurrences of Gal_4- were observed.

The effect of ultraviolet radiation on the transducing activity of lysates has been investigated in three experiments. The first two experiments were concerned with NFT lysates, the last with an HFT lysate. The effect of ultraviolet upon NFT lysates is shown in figure 2. With increasing dose of ultraviolet there is a linear increase in the activity of the lysates on Lp^+ or Lp^r assay cells until a survivial of the plaque-forming titter has become reduced about 10^{-3}. Thereafter there is a gradual decease in transduction activity with increasing dose. On Lp^s there is a slight increase in transducing activity and then a gradual decrease. The maximum reached by the lysates on Lp^+ or Lp^r cells is about four times the maximum reached on Lp^s cells. In performing this experiment about 10^8 Lp^s assay cells were used, since figure 1 indicates that this number of cells may indicate only about one-third to one-fourth the number of transductions actually present and the Lp^s assay is probably that much low. This then would suggest that the absolute number of transductions is approximated upon Lp^s cells when a sufficient number of cells are used and that the action of ultraviolet is to increase the assay on Lp^+ or Lp^r cells to the level of the absolute number present. In connection with this it should be noted that survival of the transductions of Lp^s is still about 0.5 even at the extreme doses used. From the above it is suggested that the action of ultraviolet is several fold. First and most rapid is the destruction of plaque forming activity of Lp^s cells. Secondly, to destroy that property of the phage which causes them to be "excluded" by lysogenic cells, as regards transduction, and thirdly to destroy

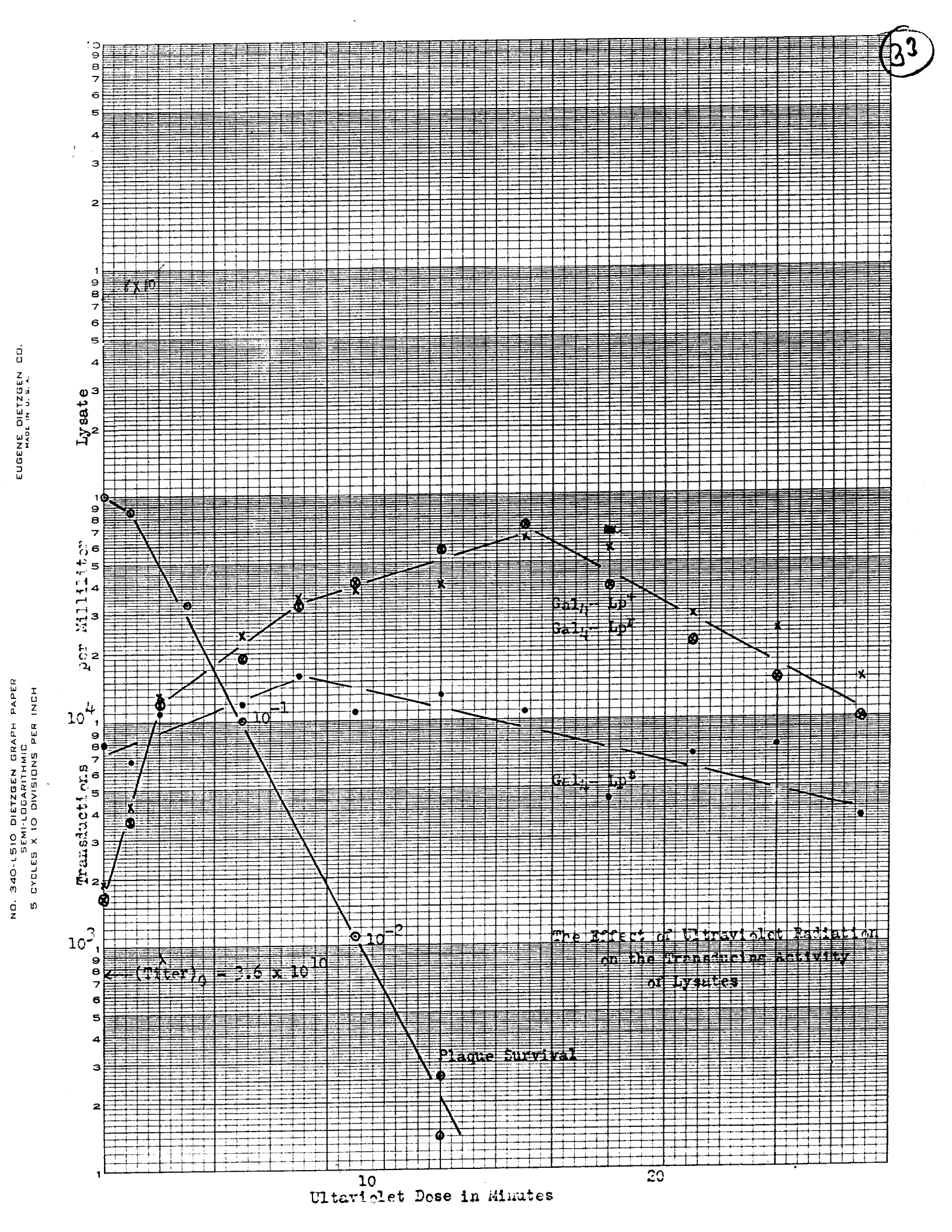
Table

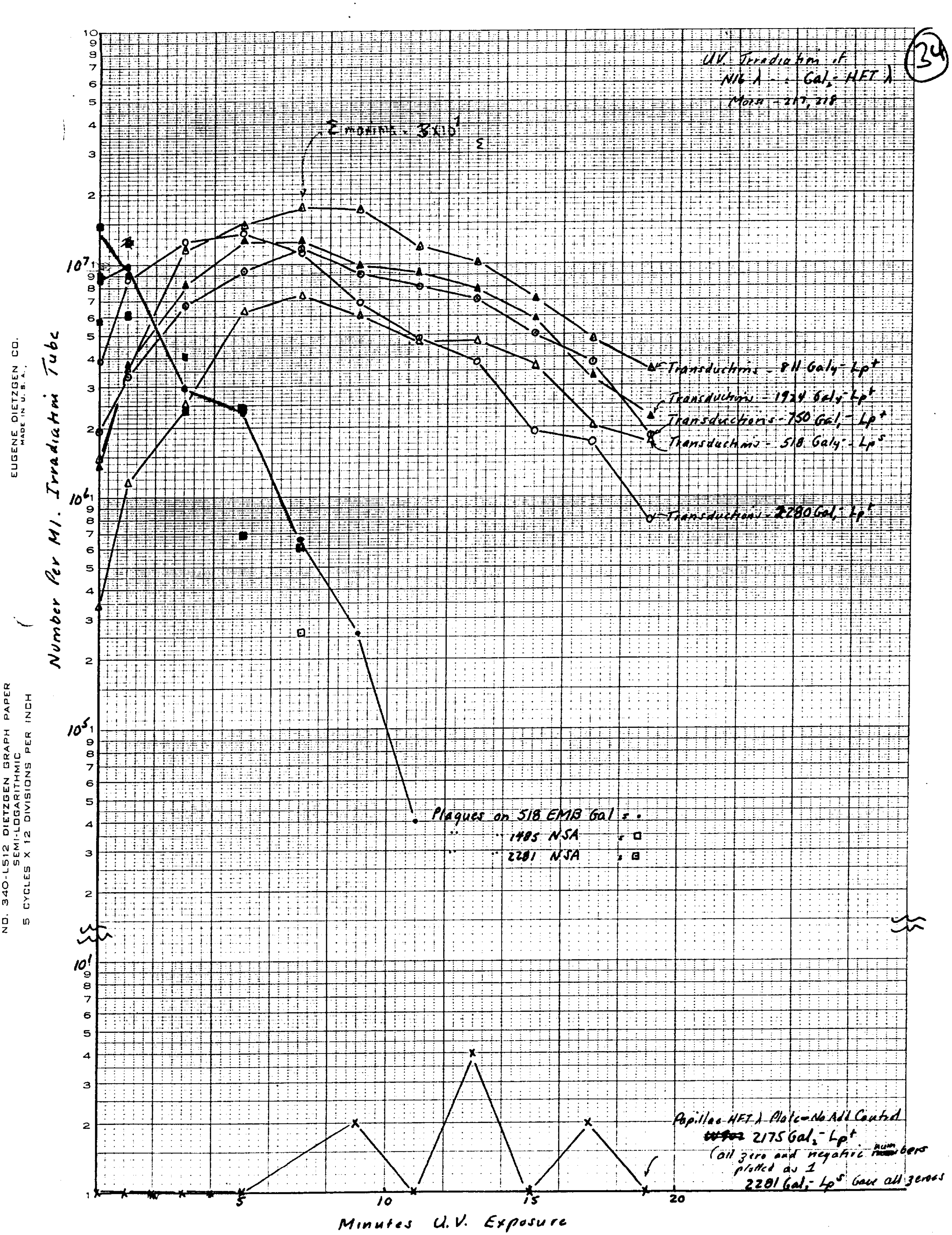
Transduction Assay of Some Galactose Negative Mutants Induced by Means of Ultraviolet

Culture Treated	Mutant Designation	Transduced by HFT Gal_1-	Gal_2-	Gal_4-	Possible Genotype
W1673 Lp^s	W2310	0	+	0	Gal_1-Gal_4-
	W2311	0	+	0	" "
	W2312	0	0	0	nontransducible
	W2313	+	0	+	Gal_2-
	W2314	+	+	+	Gal_x-
	W2315	+	+	+	Gal_x-
	W2316	0	+	+	Gal_1-
	W2317	0	+	0	Gal_1-Gal_4-
	W2318	0	0	0	nontransducible
W1765 Lp^s	238-2	0	0	0	nontransducible
	238-5	+	+	+	Gal_x-
	238-6	0	+	+	Gal_1-
	238-8	+	+	+	Gal_x-
	238-10	+	+	+	Gal_x-
	238-11	0	+	0	Gal_1-Gal_4-
	238-12	+	0	+	Gal_2-
	238-13	+	0	+	Gal_2-

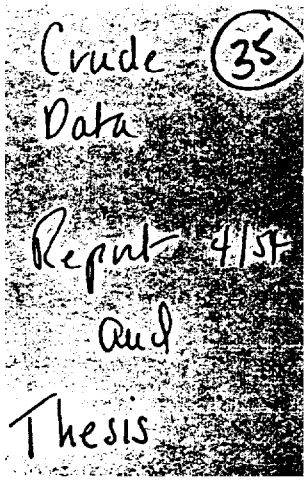
the transducing activity itself, perhaps by destroying the adsorption of the phage particles.

The effect of ultraviolet on HFT lysates is similar to that of UV on NFT lysates. The increase in transducing activity with dose in this case is not as great as with NFT lysates. A maximum is reached that is approximately equivalent to the plaque titer of the lysate which suggests that plaque and transducing particles may be the same but that appearance of a particle as a plaque excludes its appearance as a transduction. Platings for plaque formation on EMB galactose have not indicated that one particle can function in both capacities but the appearance of a plaque might be obscured by papillae formation. The sum of the activities (maximal) of the lysate on the two assay loci is 2-3 times the plaque titer, which may be an indication that the activities are confined to a single particle. The occurrence of transductions with Lp^r genotype has been noted with this lysate, and the equivalence of plaque and transduction titer might not be expected on the assumption that in these cases the effect was accomplished by a defective phage particle which would not give rise to plaques as well as to lysogenization. (This would require that Lp^r genotypes were the result of such defective particles rather than of a defective act of lysogenization.)





34
UV Irradiation of N16 λ - : Gal - HFT λ
Σ moving - 3 x 10^1
Number Per Ml. Irradiation Tube
Minutes U.V. Exposure
10^7
10^6
10^5
10^1
5
10
15
20
Transductions - 811 Gal - Lp+
Transductions - 1924 Gal - Lp+
Transductions - 750 Gal - Lp+
Transductions - 518 Gal - Lp5
Transductions - 2280 Gal - Lp+
Plaques on 518 EMB Gal
1485 NSA
2281 NSA
Papillae HFT λ Plate - No Add Control
2175 Gal - Lp+
(all zero and negative numbers plotted as 1)
2281 Gal - Lp5 Gave all zeroes
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-L512 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
5 CYCLES X 12 DIVISIONS PER INCH


Crude
35
Data
Report
Thesis

Interaction of the Gal- lysate

Numbers of papillae/plate - 0.1 ml lysate plated

Cells	No addition →	Gal$_1^-$ 2.4×10^{10}	Gal$_2^-$ 4.9×10^{10}	Gal$_4^-$ 1.7×10^{10}	Wild 1.4×10^{10}
Gal$_1^-$ Lp$^+$	(1) 2	—	176	43	[illegible]
	(2) 2	2	—	—	405
Gal$_2^-$ Lp$^+$	(1) 14	52	11	43	—
	(2) 20	—	10	—	356
Gal$_4^-$ Lp$^+$	(1) 89	—	202	—	296
	(2) 50	85	—	—	417
	(3) 47	—	—	50	394

$\frac{24\times10^9}{3.2\times10^2} = 8\times10^7$ $\quad \frac{4.9\times10^{10}}{1.7\times10^3} = 3\times10^7$ $\quad \frac{1.7\times10^9}{4.1\times10^2} = 4\times10^7$ $\quad \frac{1.4\times10^9}{4\times10^3} = 3\times10^6$

Data from Arnold p. 92

Ly rate

Cells	Gal1 W750	Gal1 W2319	Gal1 W2343	Gal2 W902	Gal2 W2251	Gal2 W2175	V1210		Gal4 W811	Gal4 W1821
Gal1 W750	2/2, 3/0	4/0	0/0	176/2, 116/2, 83/0	49/0	148/0	92/1		8/4, 43/2, 9/1, 10/3, 8/0, 10/2, 14/2, 33/2, 25/2	31/2
7300r → W2314	25/21			428/21					128/29	
part W2343	0/1			84/1					14/1, 8/5, 12/3	
W2373				11/1			56/0		30/1	
[illegible]										
Gal2 W2175	52/14, 71/5, 50/15, 88/14	10/4	16/4	10/20, 11/14, 14/51, 0/0, 0/1			10/18		43/14, 51/5, 34/13, 50/13, 32/15	
W1210	119/2, 6/4								78/14, 56/3	
W2281	364/5, 214/0								98/0	
W1924	25/31, 43/33			235/31						
Gal4 W811	20/16, 85/50, 96/51, 55/45			147/44, 202/84, 100/2	40/2				50/47	51/47
W1736									27/12	13/12
W1402	28/17			61/17					22/17	
W518	40/45, 79/28, 73/29, 73/40, 3/2		3/2	113/4, 124/28, 153/29, 473/11		109/2	128/4		4/11, 86/163, 17/41	
W1578									18/10	
W1436	145/24									
811 prototype									18/23	

Heated

not used in entering

— see pg 121 also

no acid 37
heated 19
λ 219
} 56C - 30'

λ titer = 2.3×10^10
heated λ titer = 2.2×10^9

Culture	no acid	boiled (KA) λ	K12 λ
W1736	17	22	335
	—	13	410
W1662	—	19	311
W811	—	66	535
W1821	—	30	581
W750	0	0	409
	—	2	542
W518	—	4	2112
W1924	—	29	129

Other transduction attempts

good comparison on p g 94
W112 lp, R – lp's pick replace...

pg	marker	culture
71 (82)	lac_1	W112 (W1736 gal+R)
74	serine or glyc	W1678
75, 78	leuc	W1736
82 (83) (85)	methionine (BM⁻) (BM⁻)	58-161 (W811) (W821)
83 (85) (130)	xylose	W1821 (rpt.) (rpt.)
95	S^R	W518
96	proline	W1692, W1920
100	proline	2062 (W1092 x W1402) a galy- pr-
104, 105, 106	proline	" "
113	leucine	W1436
119	mal_x^-	~~W1185~~ W2071
180	BM⁻ (with HFT)	W518
200	pr (with HFT's)	W2062
227	pr with lyzed)	W2062

VV

Σ

Locus	Attempts	Culture
lac_1	4	W112
(ser or glyc)	1	W1678
leuc	3	W1736, W143
Methionine	4	58-161, W811, W1821, W518
Xylose	3	W1821
S	1	W518
proline	7	W1692, W1920, W2062
mal_x^-	1	W2071

for multiple transductions (other factors)

Partial attempts – (indirectly through checks to see if gal only transd.)

pg	markers	culture
84	TAB, L	W1736, W1662
86 (87)	BM lac	W811
	TAB, lac	W1736
87	BM xyl lac	W1821
93	BM lac	W750

P 133, 135

DNA ase effect

Lysate	No. plaques on 0.1 ml		Titer
	Gal4⁻ hp⁵	Gal4⁻ hp⁺	
wild untreated	960	—	—
DNA ase treated	998	—	—
gal4⁻ reversion untreated	—	201, 204	6.1×10^9
DNA ase treated	—	296	6.0×10^9

Effect of hp_2 allele on transd.

Allele	Spont.	Popular $hp_1 + hp_2^S$	$hp_1 + hp_2^R$	Pfu
Gal_1 -	1	426/1	2/1	91, 99
Gal4⁻	420/1 = 17	356/20	14/14	100
Gal_3 -				
Gal4⁻	50	296/89	57/50	92, 99

Action of lysates of $(+)^{Rev}$

PS	Culture	lw ods	$+^R$ culture	# pap
89	W1736	12	W811	191
93	W750	2	W811	144
128a	~~W578~~	~~41~~	~~W811 #1~~	~~27~~ } don't transduce 811 either
		~~41~~	~~" 2~~	~~15~~
133	W578	30	W811 #5	883
134	W811	39	W811 #5	204
135	W811	25	W811 #5	201, 296
		25	#8	291
151	811 prototroph	~~23~~	~~W811 #1~~	~~15~~
		~~11~~	~~#2~~	~~22~~
		"	#5	214 461 (another lysate)
		"	#8	389
240	W750	0	W750	648
240	W2175	10	W2175 #1	96
		6	" #2	552
240	W750	0	W811 #5	146
		1	W811 #8	153

Used in paper

Table 4

Restoration by Reverse Mutation of the Ability to Transduce ~~Previously Nontransducible loci~~

Locus	Revertant	lw ods lysate culture	Revertant lysate
Gal_1^- (Lp^+)	Gal_1^+ #1	0	648
Gal_2^- (Lp^+)	Gal_2^+ #1	10	96
	Gal_2^+ #2	6	552
Gal_4^- (Lp^+)	Gal_4^+ #5	39	204
	Gal_4^+ #8	25	291

Transduction of Lp^s + Lp^+ Lp^+ (41)

Expt	Cultures	λ	trans. assay
92	W518	+	2112/4
		2-	1112/4
	W811	+	296/89
		2-	202/89
140	W518	2-	1152/29
	W811	2-	147/44

not needed?

Lyhi λ

227 used λ on 518 WT

228 also no produce duction 2062 with gal- ... W1485 no trans. ε 750, 518, 2175

239 (1) rpt of gal/ga ... 1485 — " "

(2) growth of HFT λ lyhi · 518 — no growth

(3) used w/ 518 (above) trans. 1^-, 2^-, 4^-

Expt	Assay cult	no λ added	Lyhi λ
228	W750	3	2
	W518	9	8
	W2175	7	8
239	W750	2	0
	W518	13	8
	W2175	6	2

254		
W750	—	3
W518	—	6
W2281	—	9
W2373	—	6
W811	—	39

Absorption of λ

2

ells	μg	λ absorbed	transduction absorbed
~~W8~~	~~127~~	~~61~~	~~50~~
W57	127	52	67.5
	—	~~54~~	~~7~~
W44	285 ?		
W30	226 ?		
W2175	11 ?		

Relationship of the gals⁻ (199) (210) page

Cross	minimum no prototrophs	no (+)	% (+)	Recombinants
$Gal_1^- \times gal_2^-$	>1500	2	<0.13	199
$Gal_1^- \times gal_3^-$	>1600	2	<0.13	– 200
$Gal_1 \times gal_4^-$	4588		0.13	210
$Gal_2^- \times gal_4^-$	2654		0.22	174, 175
$Gal_1^- \times gal_2^-$	>6517	4	<0.06	214
$Gal_1 \times gal_2$ (2751)	3606	1	0.027	240
	623			
Σ $gal_1 + gal_2$	>11620	7	<0.06	

.06 .13
2 ⟷ 1 ⟷ 4
⟵ .24 ⟶

16/19
0.81
19 | 160
152
30

Correlation of transduction with lysogenicity

Allele	source lysate	no	% lysogenic	Ref
gal_4^- Tp^s W518	wild	18	100	120a
gal_4^- Tp^s W518	gal_2^-	19	100	146
gal_4^- Tp^s W518	gal_x^- (842)	22	100	147
"	" (842)	23	100	153
gal_4^- Tp^r	wild	29	3.	216
gal_4^- Tp^r W1924	~~gal_2~~	18	5.5%	213
gal_2^- Tp^s W2281	wild	9 (16)	44 (44)	229 A
	gal_1^-	23 (21)	~~91~~ 95 (~~92~~)	229 B
	gal_4^-	19 (31)	81, (81)	229 C
	wild	18	67	250
W2373	gal_4^-	22	77	249A
	gal_2^- (1210)	24	88	249B
	gal_2^-	12	58	249C
	wild	23	87	249D

0.87
23 | 20.0
184
160
161

0.15
13 | 2.0
1.3
70

0.54
124 | 7.0
6.
70

2 The Occurrence of Stable Transductants

λ Source

Recipient Cells	K-12		Gal$_1$- W750		Gal$_2$- W902		Gal$_3$- W2238		Gal$_4$- WF11	
	Stable Expected	Observed	Stable Expected	Observed	Stable Expected	Observed	Stable Expected	Observed	Stable Expected	Observed
Gal$_1$- 234^{rr}	1/143	42			1/84	3.5 $X^2 = 6.25$	~~not done~~ 4/24*	10	12/27	27 * all stable
Gal$_2$-	17/248	20.7 $X^2 = 6.87$	14/83	61.1			~~not done~~ 7/48 = .32		14/79	52.1
Gal$_3$-	not done		2/88	88 all stable	5/34	34 all stable			12/56	48.7 (possibly 56)
Gal$_4$- Lp^s	19/835	383	29/72	72 * all stable?	11/472	19.7	not done, doesn't go?			
Gal$_4$- Lp$^+$	41/573	133	51/96	96 * all stable?	47/147	30.6 **	not done doesn't go?			
Gal$_4$- Lp^r	3/320	127	25/31	not done * all stable?	31/238	49.6 $X^2 = 12.7$	not done			

* These may be instances of stable transductions or just estimates of the variation in spontaneous reversions on the plates.

** Estimated from two different experiments.

Explanation:

Stable Expected = $\frac{\text{no. papillae control plate}}{\text{no. papillae transd. plate}} = \frac{\text{spont. reversions}}{\text{transductions + sp. reversions}}$

Observed = $\frac{\text{no. stable observed}}{\text{no. in sample taken}} \times \frac{\text{no. papillae transd plate (= sp. + revers. transd.)}}{\text{no. papillae in sample taken}}$

Stability determined by streaking out single colonies (consecutive) on EMB gal.

Segregant Σ

Expt	Allele Homo	Allele Hetero	Numbers Homo	Numbers Hetero	Homo Hetero	Total
248	1⁻ +	—	✓16	—	—	16
249D	1⁻ s	—	✓9	—	—	9
247 A	2⁻ +	—	✓15	—	—	15
233	2⁻ s	—	✓16	—	—	16
212	4⁻ +	—	✓20	—	—	20
205	4⁻ s	—	✓13	—	—	13
—	4⁻ R	—	—	—	—	—
196	2⁻ +	—	✓20	—	—	20
192A	1⁻ +	—	✓17	—	—	17
247C	1210 2⁻ +✓	1	19	2	0	21
236 B	2⁻ s✓	1	20	0	0	20
209	2175 2⁻ +✓	1	14	3	2	19
230	750 1⁻ +✓	2 (902)	18✓	1	0	19
243	750 1⁻ +✓	2 (1210)	18	3	0	21
249 B	1⁻ s✓	2 (1210)	6	1	0	7
249 C	1⁻ s✓	2 (902)	1	0	0	1
202	4⁻ +✓	2	16	3	0	19
242	4⁻ s✓	2 (1210)	17	2	0	19
198	4⁻ s✓	2 (902)	18	3	0	21
~~213~~	~~4⁻ R✓~~	~~2~~	15	3	0	18
192B	1⁻ +✓	2 (902)	18.	5	0	23
249A	1⁻ s✓	4	✓1	0	0	1
247B	1210 2⁻ +✓	4	22	1	0	23
236 C	2⁻ s✓	4	21	1	1	23
207	2175 2 +✓	4	9	7	0	16
			359✓	35✓	3✓	397 (397)
24			90.5	8.8	0.76	100.06
single transd. 146	✓4⁻ ~~s~~	2 (902)	17.	2	1	20
single transd. 145	✓4⁻ s	+	15	0	0	15
170a	✓4⁻ s	+	18	0	0	18
			409	37	4	(45[illegible])
			(90.9%)	(8.2%)	(0.88%)	

Nat. ~~Segregant~~ Segregant from wild type transduct

	Homo	Hetero	Total
169	168	0	188
2	100	0	

409 / 169 / 240; 281 / 169 / 450; 248 / 169 / 417; 409 / 136 / 273

Homo	Hetero	Di	Total
390	35	3	
+17	2	1	
240	37	4	~~247~~ 281
240	37	4	281

Transd.	Homo	Hetero	Di	Total
Wild type	169	0	0	169
Between sel (?)	240 (.85)	37 (0.13)	4 (0.014)	281
Total	409 (0.9)	37 (0.82)	4 (0.0088)	45

Occurrence of Stable transductions - Reversed

Lysates

Cells	Wild 1412 Expected	Observed	Gal1- W750 Expected	Found	Gal2- W902 Expected	Found	W1210 Expected	Found	Gal4- W811 Expected	Found
Gal1-										
W2343 λp+	1/143	42	—		1/84	3.5	1	—	12/27	27
2373 λp+	1/33	14	—		1/11	11	0/52	19.5	1/30	28.7
W750	1/46	1.9	—		—		1/92	0		
Gal2-										
W2175 λp+	17/248	20.7	14/83	61.1	—		—		14/79	52.1
W1210 λp+	4/29	6.3	2/65	0	—		—		5/56	0
W2281 λp+	0/46	~~15.2~~ 11.6	0/214	26.7	—		—		0/98	3.9
1-										
W578 λp+	19/835	383	29/72	72	11/472	19.7	4/128	21.4	—	—
W811 λp+	41/573	133	51/96	96	47/147	[illegible]	—	—	—	—
W1924 λp R	31/330	127	—	—	31/238	49.6	—	—	—	—

Stable expected = # pap. cribbed / # pap. lysate plate = spont / spont + transd.

Observed = # stable obs / # in sample × # pap transd. plate / # pap in sample

Nature of the Segregants

Cells	Wild	Gal_1^- ±210	Gal_2^- W902	Gal_2^- W1210	Gal_4^- W911
W2342 4pt	17 gal_1^-	—	14 gal_1^- 1 gal_1^-	— —	no segregants found
W2373 4pt	9 gal_1^-	—	1 gal_1^-	6 gal_1^- 1 gal_2^-	1 gal_1^-
W1750 4pt	16 gal_1^-	—	16 gal_1^- 1 gal_2^-	18 gal_1^- 3 gal_2^-	no segregants found.
W2175 4pt	20 gal_2^-	14 gal_2^- 3 gal_1^- 2 gal_2^- gal_1^-	—	—	8 gal_2^- 7 gal_4^-
W1210 4pt	15 gal_2^-	19 gal_2^- 2 gal_1^-	—	—	22 gal_2^- 1 gal_4^-
W1281 4pt	16 gal_2^-	20 gal_2^-	—	—	21 gal_2^- 1 gal_4^- 1 gal_2^- gal_4^-
W578 4pt	13 gal_4^-	no seg found	18 gal_4^- 3 gal_2^-	17 gal_4^- 2 gal_2^-	—
W811 4pt	20 gal_4^-	no seg found	16 gal_4^- 3 gal_2^-	—	—
W1924 4pt	29 gal_4^-	no seg found	15 gal_4^- 3 gal_2^-	—	—
—	15 5	—	~~35~~	—	—

Type of Segregant

Transl. Lysate	Homotypic	Heterotypic	Homo-Hetero	Total
Wild	169	0	0	169
gal(-) on gal(-)	240 (0.854)	37 (0.132)	4 (0.014)	281
Total	409 (0.91)	37 (0.08)	4 (0.0088)	450

Summary HFT deletion - Analysis of Segments by Transduction Test

HFT Lysate

Transduced Cell Genotype	Gal_1^-	Gal_2^-	Gal_4^-
Gal_1^- W750	—	18 { 10 gal_1^- ; 2 gal_2^- ; 1 $gal_1^- gal_2^-$	18 { 9 gal_1^-
Gal_2^- W2175	18 { 6 gal_1^- ; 3 gal_2^- ; 1 $gal_2^- gal_1^-$	—	18 { 8 gal_2^- ; 4 gal_1^-
Gal_4^- W565	not done	18 { 15 gal_4^-	—

# cells	no papillae	1/#cell	$\times 10^{-9}$	1/no papillae
1.4×10^{9}	2504	0.59×10^{-9}	0.59	0.4×10^{-3}
7×10^{8}	1780	0.14×10^{-8}	1.4	0.57×10^{-3}
3.5×10^{8}	1472	0.28×10^{-8}	2.9	0.68×10^{-3}
1.75×10^{8}	1120	0.57×10^{-8}	5.7	0.89×10^{-3}
8.75×10^{7}	688	0.11×10^{-7}	11.0	1.5×10^{-3}
4.4×10^{7}	581	0.23×10^{-7}	23	1.72×10^{-3}
2.2×10^{7}	562	0.46×10^{-7}	46	1.75×10^{-3}
1.1×10^{7}	533	0.91×10^{-7}	91	1.87×10^{-3}
5.5×10^{6}	509	0.18×10^{-6}	180	1.97×10^{-3}

Extrapolation to ~~zero~~ infinite no cells gives reciprocal no of papillae
is $0.34 - 0.36 \times 10^{-3}$
$= 2780 - 2980$ pap / 0.1 ml
$27800 - 29800$ / 1 ml
ave $= 2.88 \times 10^{4}$

From mediation experiment -
Back extrapolation
$\frac{5 \times 10^{5} \text{ transd}}{36 \times 10^{10} \lambda} = \frac{1.5 \text{ transd}}{10^{5} \lambda} =$

In this experiment estimated λ titer $= 2.7 \times 10^{10}$

$\frac{2.88 \times 10^{4}}{2.7 \times 10^{10}} = \frac{1 \text{ transd}}{10^{6} \lambda}$

$\frac{1}{x} = 3.6$

$3.6x = 10$

$\frac{1}{x} = 0.36$

[illegible]

$1.00 = [illegible] x$

2.78×10^{3}

2780

2980